Why Software Really Will Eat the World—and Whether We Should Worry

RUSSELL D. ROBERTS

Predicting the future of the economy is a fool's game. Go back fifty or one hundred years and imagine trying to see where we are now. Our Internet-connected world, with its consequences for business and entertainment, was unimaginable even twenty-five years ago, so talking about what comes next demands humility. What I will try to do here is not predict the future but rather suggest what trends and processes may prove important in the coming decades and what might interrupt those trends along the way.

Some economists—Robert Gordon (2012), for example—have suggested that the rate of productivity growth has slowed significantly, so we should expect low growth rates for some time looking forward. I have a different perspective. Much of the improvement in the quality of our daily lives cannot be captured with traditional methods of data collection using standard economic variables such as gross domestic product. The explosion in low-cost entertainment via the Internet, for example, has been extraordinary, and much of that pleasure and delight is scarcely monetized, if at all.

And I think the best is yet to come as the digital revolution, ubiquitous smartphones, and Moore's Law continue to change our lives. Personalized medicine, online education, and transportation are just a few important areas where I think technology is potentially transformative. Let's look at each of these areas briefly.

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In medicine, you can use your iPhone to take a picture of the inside of your child's ear, upload it to the Cloud, and have a doctor tell you whether your child has an ear infection. You can monitor whether your elderly parents are taking their medication from a thousand miles away. A single drop of blood can now be used for dozens of tests at lower prices than those charged by the current laboratory duopoly, Quest and Laboratory Corporation of America. You can consult with a doctor online for general health issues. You can even bring a doctor to your house, Uber style.

Khan Academy, Udacity, Coursera, and EdX are beginning to change the world of education. They offer low-cost, high-quality pedagogy. Many problems remain with testing, certification, and classroom interaction, but we are at the very beginning of this revolution. Much trial and error are under way, and the best techniques will survive and thrive.

In transportation, the driverless car and truck will save thousands of lives each year, potentially making human driving obsolete, reducing the necessary width of city streets, ending the need for each house to store a car either in the driveway or the garage, and giving older people who struggle with driving a new sense of freedom.

All of these digitally driven improvements are examples of what entrepreneur and venture capitalist Marc Andreessen calls "software eating the world" (2011). Software is transforming existing industries in quantum leaps rather than through incremental changes.

If driverless cars and trucks come to be, they don't just reduce the number of taxi drivers and truck drivers. They eliminate an entire industry. If robots can do surgery with little or no human involvement, the demand for human doctors falls dramatically. If I can learn everything I want to know online, the best teachers will teach millions, and the need for teachers will be a tiny fraction of what it is now.

Are these reductions in employment (driven by immense productivity) a feature or a bug? Throughout human history, these kinds of changes created an ever-growing prosperity. Getting more from less is the standard way technology has led to higher living standards in the past. When economies can produce more output with fewer inputs, that frees up those inputs to create other things. So the immense improvements in agricultural productivity over the past century freed up workers who once would have been farmers to do other things instead. We gained cheaper food and more of many other things—airplanes, cars, smartphones, movies enhanced with computer-generated imagery, health care, and so on. If 40 percent of the workforce had to work in agriculture today as they did in 1900, we wouldn't have all of those new innovations. We wouldn't be able to spare the people to think of them, create them, and produce them.

But if software eats the world, will new opportunities be created to take advantage of the skills of displaced workers? What will all the people driving taxis and trucks do if driverless cars and trucks become common? Some economists worry that

virtually every activity will be more cheaply produced or created by smart machines than by people.

Activities that will remain are conceiving and creating more clever or more useful machines. But the ability to do this is scarce. What will the rest of the workforce do?

I remain guardedly optimistic. Just as it is hard to guess or predict what humans will be good for in a smart-machine age, it is hard to imagine that we will be unable to come up with new activities that are also productive. Another worry is that when such activities that we cannot imagine today do indeed become available, the wages for the lowest-skilled workers will be distressingly low. Perhaps. But those wages will go a long way in a world where software is eating the world.

The key characteristic of software is that additional copies are nearly free. That means we don't need more and more workers to produce the additional copies of a software program's output in the way we need more and more workers to create more traditional brick-and-mortar products. This reality cuts both ways for the average worker. They may not be needed to produce those extra copies, but those extra copies will be very inexpensive, so even seemingly low wages will allow for a very high standard of living.

The biggest problem may be that a large proportion of humanity will be able to live very well without having to do much work. The challenge we will face will not be physical scarcity but spiritual scarcity. Many of us get meaning from our work. What will life be like if many of us hardly have to work at all? I don't know the answer other than to point out that this is a better problem to have than the challenges of a world where a billion people or more live at the edge of subsistence.

The other important observation to make is that these transformative trends are threatened by regulatory or other types of barriers. Uber drivers face arrest or being forced to work in the same way that taxi drivers do. Universities (encouraged by faculty members) are uneasy with accepting online courses because they correctly see them as a threat to many faculty members' livelihood. Existing medical companies are fighting the medical innovators. All of these changes must overcome psychological barriers, too.

Right now, in 2015, the regulatory challenges look formidable. But it is hard to imagine that existing competitors will be able to stop changes that make consumers' lives mainly better. Improvements happen. They happen even when existing competitors flex their political muscle to stop those improvements. They may be slowed down. In America, they are almost never stopped.

Government does many stupid and wasteful things, but that doesn't stop creative, driven people from continuing to innovate. It doesn't stop my kids from getting a decent education. But it stops other kids who are growing up in more challenging circumstances from participating in the parts of the economy that remain dynamic. The minimum wage and our lousy public schools don't hurt my kids. But they hurt millions of others. I don't know if the digital revolution will weaken the public-school monopoly or force public schools to do a better job. But if we want a future where

all people have a decent chance to flourish, introducing a little more competition into schools and labor markets would go a long way.

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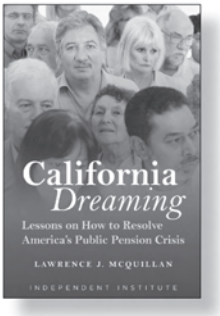

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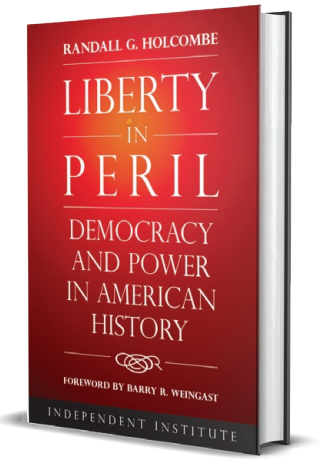

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